Sounding Rocket Working Group

Project Office Update

June 26, 2003

FY '03 Sounding Rocket Schedule

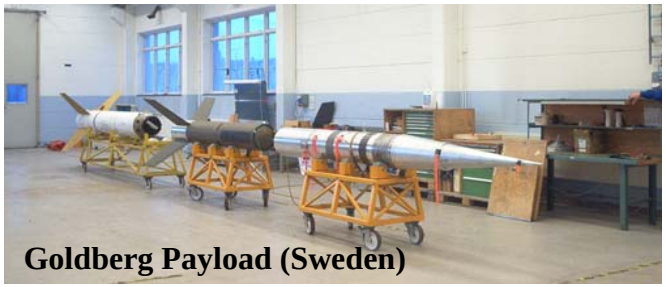
#	Vehicle Type	FY 2003 Mission	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
		WALLOPS ISLAND												
1	Terrier Orion	VALPE/AIRFORCE RESEARCH LAB		▲										
2	Terrier Malemute	HOWLETT/UTAH STATE UNIV.									▲			
3	Black Brant XI	RED DOG/LINCOLN LAB								▲				
4	Black Brant XI	RED DOG/LINCOLN LAB									▲			
5	Terrier Orion	KRAUSE/NASA-NSROC									△			
6	Orion	PARROTT/NASA									▲			
7	Orion	LAUFER/UNIVERSITY OF VIRGINIA												△
8	Nike Black Brant VB	EARLE/UNIVERSITY OF TEXAS									△			
9	Terrier Orion	EARLE/UNIVERSITY OF TEXAS									△			
10	Terrier Orion	EARLE/UNIVERSITY OF TEXAS									△			
11	Terrier Orion	EARLE/UNIVERSITY OF TEXAS									△			
12	Terrier Orion	VALPE/AIRFORCE RESEARCH LAB											△	
13	Terrier Orion	KANE/PENN STATE UNIVERSITY												△
14	Terrier Orion	KRAUSE/NASA-NSROC												△
		SWEDEN												
15	Terrier Orion	GOLDBERG/GSFC				▲								
16	Terrier Orion	GOLDBERG/GSFC				▲								
		PFRR												
17	Black Brant IX	LABELLE/DARTMOUTH				▲								
18	Black Brant IX	LARSEN/CLEMSON UNIVERSITY						▲						
19	Black Brant VB	LARSEN/CLEMSON UNIVERSITY						▲						
20	Terrier Orion	LARSEN/CLEMSON UNIVERSITY						▲						
21	Terrier Orion	LARSEN/CLEMSON UNIVERSITY						▲						
22	Black Brant X	CONDE/UNIV. OF ALASKA						▲						
23	Terrier Orion	CONDE/UNIV. OF ALASKA						▲						

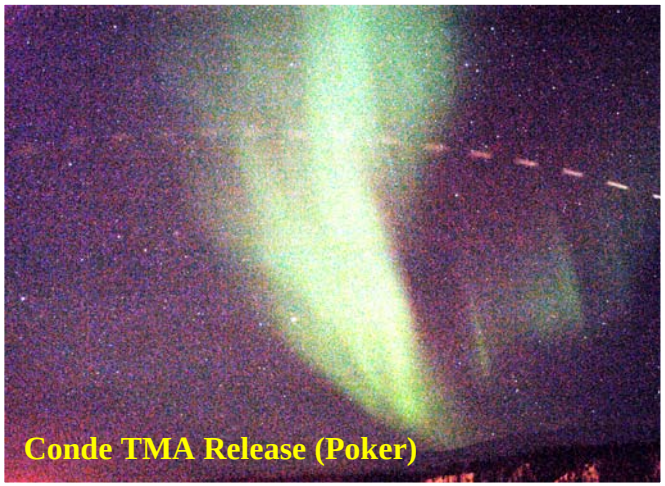
FY '03 Sounding Rocket Schedule

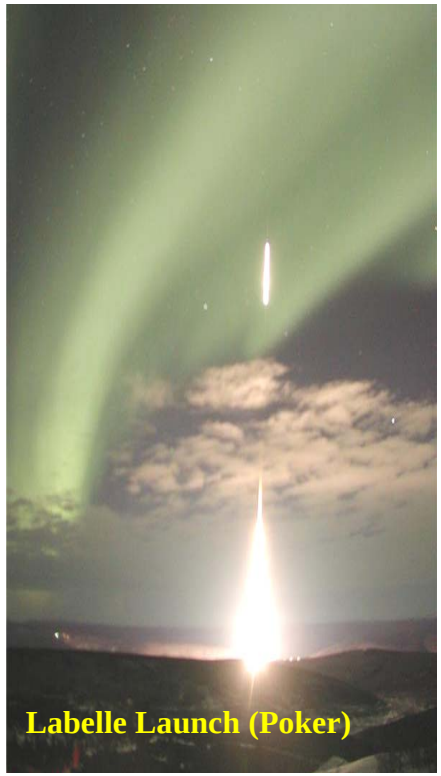
#	Vehicle Type	Mission	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
		WSMR												
24	Black Brant IX	WILKINSON/UNIV. OF COLORADO		▲										
25	Black Brant IX	MARTIN/CAL TECH.					▲							
26	Black Brant IX	STERN/SWRI							▲					
27	Terrier Orion	ERDMAN/EMBRY-RIDDLE UNIV.									△			
28	Terrier Orion	ERDMAN/EMBRY-RIDDLE UNIV.									△			
29	Black Brant IX	WOODS/UNIVERSITY OF COLORADO											△	
30	Black Brant IX	MOSES/NRL											△	
31	Black Brant IX	JUDGE/USC											△	
		SVALBARD (NORWAY)												
32	Black Brant X	PFAFF/GSFC			▲									

32 flights supporting 22 scientific studies

Launch Activity


Goldberg Payload (Sweden)


Conde TMA Release (Poker)


Labelle Launch (Poker)


Student Hybrid (WFF)


Red Dog (WFF)


Student SubSEM (WFF)

Also Launched:

- Larsen (4 ea PFRR)
- Stern (WSMR)
- Martin (WSMR)

2004 Candidate Missions

NO.	MISSION	EXPERIMENTER/ORGANIZATION	RANGE	DATE	TIME	RESPONSIBILITY
1.	36.208 UG	FELDMAN/JHU	WS	OCT	NIGHT	MARSH
2.	36.174 UL	CLARKE/BOSTON UNIV.	WS	DEC	NIGHT	J. SCOTT
3.	35.035 UE	KINTNER/CORNELL UNIV.	NOR	JAN	NIGHT	VIEIRA/PAYNE
4.	12.054 GT	KRAUSE/NASA-NSROC	WS	JAN	DAY	MARSH
5.	36.173 UG	NORDSIECK/UNIV. OF WISCONSIN	WS	MAR	NIGHT	PAYNE
6.	36.203 US	DAVILA/GSFC	WS	APR	DAY	PAYNE
7.	36.209 UG	WILKINSON/UNIV. OF COLORADO	WS	MAY	DAY	GIBB
8.	36.193 US	KANKELBORG/MONTANA ST. U.	WS	JUN	TBD	PAYNE
9.	29.036 UE	HYSELL/CORNELL UNIV.	KWAJ	JUN	NIGHT	HICKMAN/B. SCOTT
10.	29.037 UE	HYSELL/CORNELL UNIV.	KWAJ	JUN	NIGHT	HICKMAN/B. SCOTT
11.	41.043 UE	HYSELL/CORNELL UNIV.	KWAJ	JUN	NIGHT	HICKMAN/B. SCOTT
12.	41.044 UE	HYSELL/CORNELL UNIV.	KWAJ	JUN	NIGHT	HICKMAN/B. SCOTT
13.	41.045 UE	HYSELL/CORNELL UNIV.	KWAJ	JUN	NIGHT	HICKMAN/B. SCOTT
14.	41.046 UE	HYSELL/CORNELL UNIV.	KWAJ	JUN	NIGHT	HICKMAN/B. SCOTT
15.	41.041 UE	LEHMACHER/CLEMSON	KWAJ	JUN	NIGHT	HICKMAN/GASS
16.	41.042 UE	LEHMACHER/CLEMSON	KWAJ	JUN	NIGHT	HICKMAN/GASS
17.	21.132 GE	PFAFF/GSFC	KWAJ	JUL	NIGHT	HICKMAN/GIBB
18.	21.133 GE	PFAFF/GSFC	KWAJ	JUL	NIGHT	HICKMAN/GIBB
19.	41.047 GE	PFAFF/GSFC	KWAJ	JUL	NIGHT	HICKMAN/GIBB
20.	41.048 GE	PFAFF/GSFC	KWAJ	JUL	NIGHT	HICKMAN/GIBB
21.	21.134 UE	GELINAS/CORNELL UNIV.	KWAJ	JUL	NIGHT	HICKMAN/J. SCOTT
22.	21.135 UE	GELINAS/CORNELL UNIV.	KWAJ	JUL	NIGHT	HICKMAN/J. SCOTT
23.	36.212 UG	WILKINSON/UNIV. OF COLORADO	WS	SEP	NIGHT	B. SCOTT

2005 Candidate Missions

NO.	MISSION	EXPERIMENTER/ORGANIZAITON	RANGE	DATE	TIME	NASA/NSROC RESPONSIBILITY
1.	21.136 CE	HECHT/AEROSPACE CORPORATION	HI	NOV	NIGHT	GIBB
2.	21.137 CE	HECHT/AEROSPACE CORPORATION	HI	NOV	NIGHT	GIBB
3.	41.051 CE	HECHT/AEROSPACE CORPORATION	HI	NOV	NIGHT	GIBB
4.	41.052 CE	HECHT/AEROSPACE CORPORATION	HI	NOV	NIGHT	GIBB
5.	41.053 CE	HECHT/AEROSPACE CORPORATION	HI	NOV	NIGHT	GIBB
6.	36.207 US	CRUDDACE/NRL	WS	NOV	DAY	GASS
7.	40.017 UE	LYNCH/DARTMOUTH	FB	FEB	NIGHT	J. SCOTT

Oriole-based Vehicles

- **Talos-Taurus-Oriole**
  - June ’04 Demo Flight
  - Partial funding provided by NGLT HyTEX effort
  - Seeking funding from Ames

- **Talos-Oriole**
  - July/Aug ’04 Demo Flight
  - Partial funding provided by JPL (ST-9 pre Phase A)
  - Seeking funding from Ames

- **Terrier-Oriole**
  - Needs to become operational
  - Partnership w/ NAVSEA at WSMR will provide funding for several initial flights
- **Terrier-Oriole-TBD**
  - Vehicle will eventually be needed to fill Nihka void
  - NAVSEA relationship will likely fund vehicle development

High Altitude Sounding Rocket

- Candidate vehicle configuration has been established
- Development plan being created
- Funding approval needed
- <u>Details will be addressed as a separate agenda item</u>

Mesospheric Sounder

- After significant effort, the SRPO believes it can obtain the MRLS motors
- Relationship w/ NAVAIR @ WSMR facilitated acquisition of motors (benefit of reimbursable effort)
- More detail will be provided by NSROC during the afternoon session

Outreach

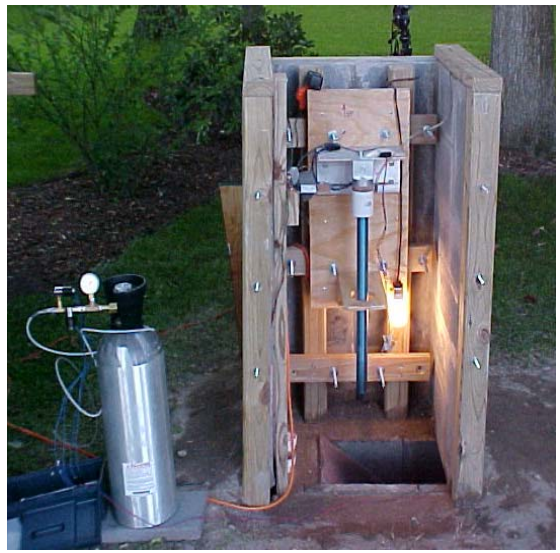
- Continue to fly one Sub-SEM payload annually
  - 4 High Schools & 1 Elementary School
  - 500 students
- Small-scale Educational Rocket Initiative (SERI) concept vehicle
  - Under development by summer intern students
  - Payload and vehicle design, analysis and fabrication
  - Very low cost
- Supporting University w/ student-built rocket project
- Working to formalize the university-level student flight program

Sub-SEM students waiting to get access to the payload after the 2003 flight

SERI Concept Rocket

New Propulsion Concepts

- SRPO hopes to foster the development of hybrid rocket motor concepts that have potential applications to the sounding rocket program
- Benefits
  - Lower cost
  - Less expensive/complicated logistics
  - Can be throttled (tailored trajectories)
  - Potentially reusable
- The SRPO has already influenced the focus of the Ames/Stanford development efforts
  - Focus on storable oxidizers (NO3 rather than LOX)
  - Moving towards Orion-class demo flight as next step
- Currently in a “get smart” mode



Facility Status

- F-10 (shops, offices, labs)
  - Small Shuttle Payloads group has moved to different building – more space for NSROC
  - North end of building has been refurbished
  - Two Front Ground Stations have been refurbished
- Small Sounding Rockets R&D lab is being established
- Big improvements at Wallops on tap over the coming years…

Findings

January 13, 2003 SRWG Meeting

I. High Altitude Sounding Rocket

- The SRPO greatly appreciates the enthusiastic endorsement of HASR concept
- The SRPO is currently working the funding issues
- Concept refinements are ongoing
- <u>Will be discussed as a separate agenda item</u>

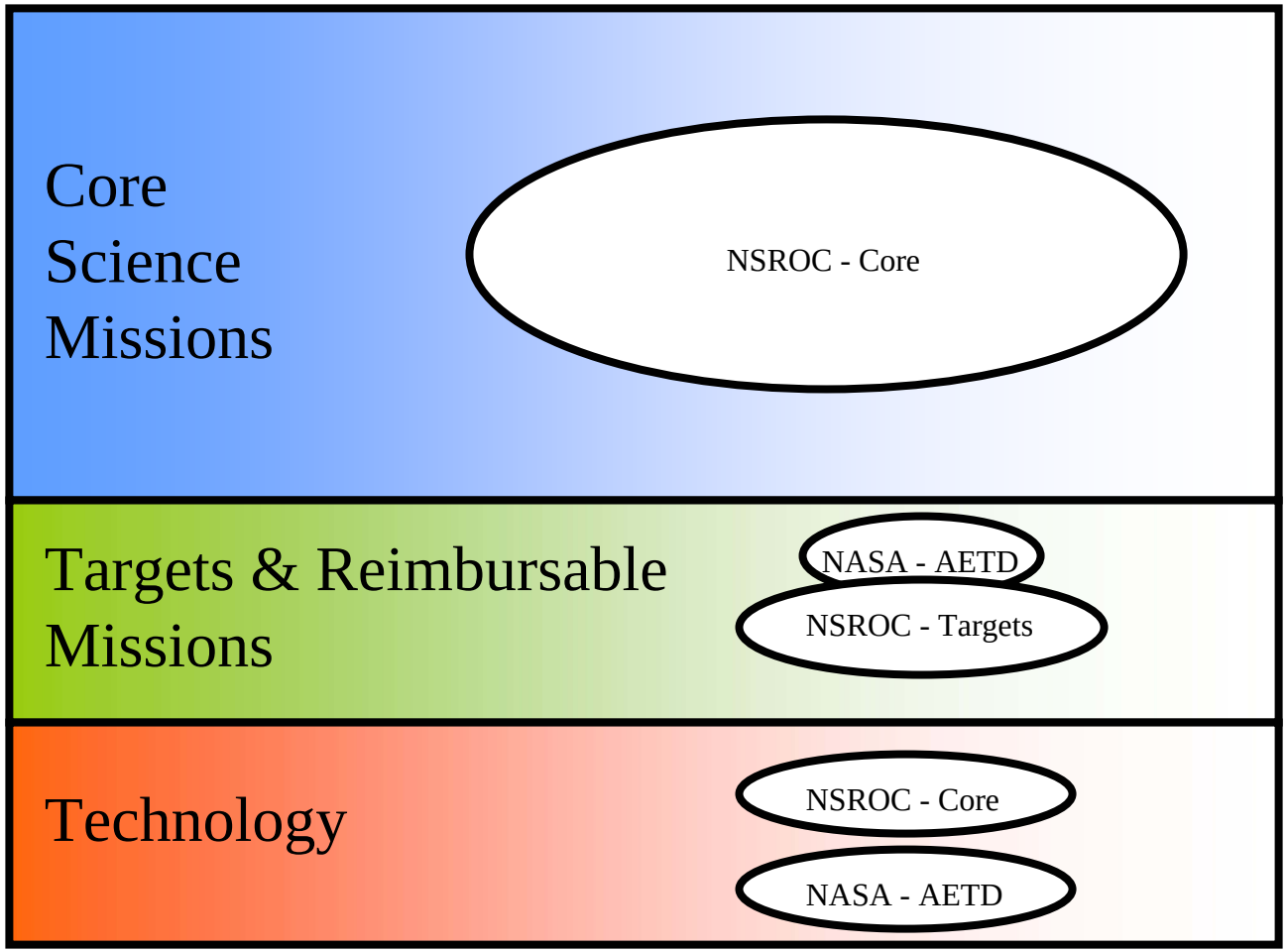
II. New Mesospheric Rocket

- The SRPO is pleased to here of the continued desire to develop a new Mesospheric Sounding Rocket
- The SRPO has encountered difficulty in gaining access to the MRLS motor assets, but…
- Our relationship with NAVSEA at WSMR has provided the SRPO with a conduit for accessing the necessary assets
  - Approximately 30 motors will be obtained for development and early flights
- The SRPO is targeting the Winter Poker launch operations for the first operational flights. The developmental flight(s) will be conducted at WFF.

III. Apparent Resource Conflicts

- The SRPO continues to keep core Code S science missions as its highest priority
- Priority ranking
  - Code S Science
  - NASA Reimbursable
  - External Reimbursable
  - Educational Outreach
- WFF Range priorities may contrast with PI requirements – this is no different than any other range
- NSROC is brining on new FTEs and plans to establish a targets group
- GSFC Engineering Directorate (AETD)
  - Understands the need for increased support for the program
  - Civil Service FTE will take on certain technology initiatives

Workforce Allocation

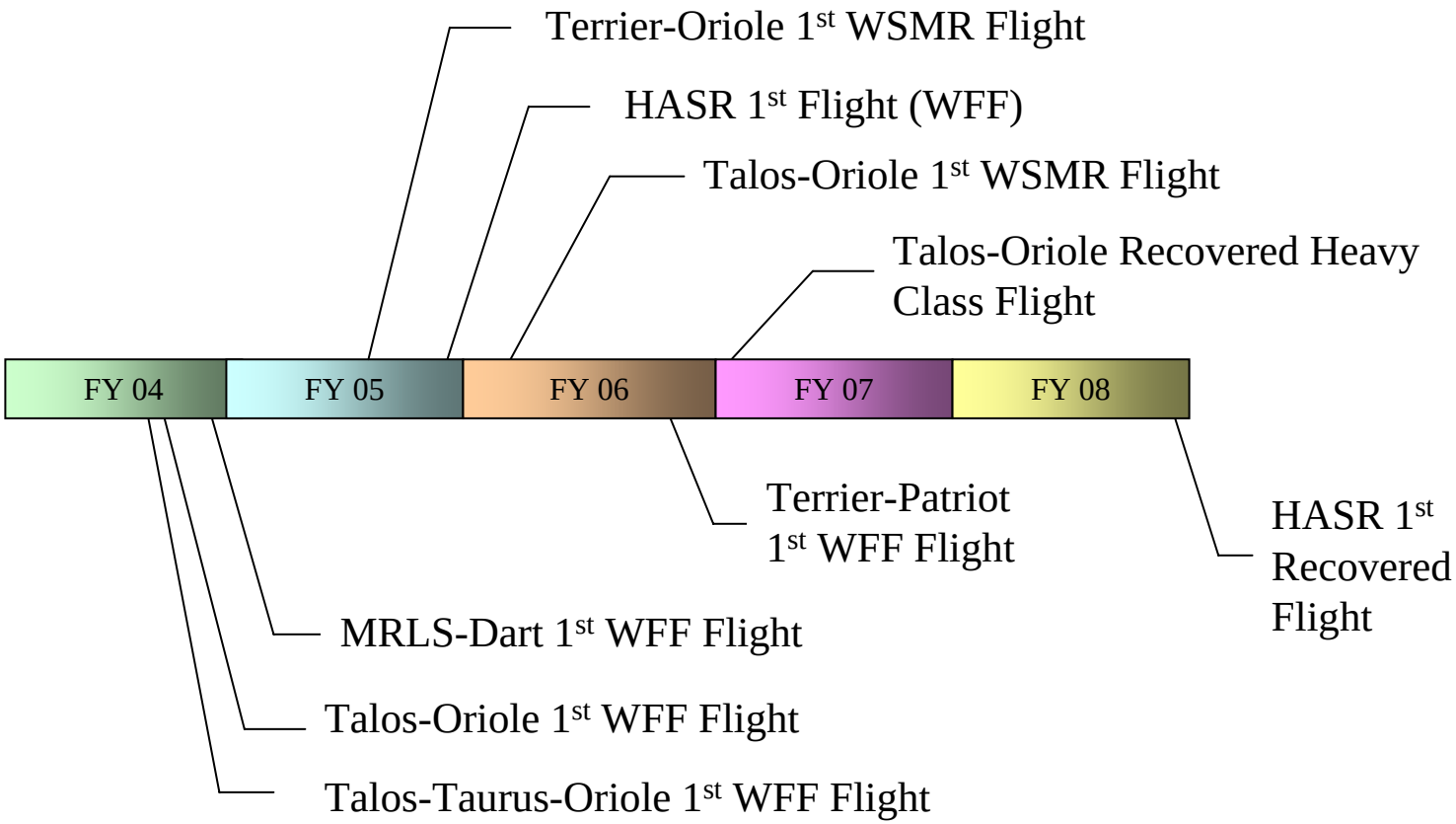


IV. Technology Roadmap

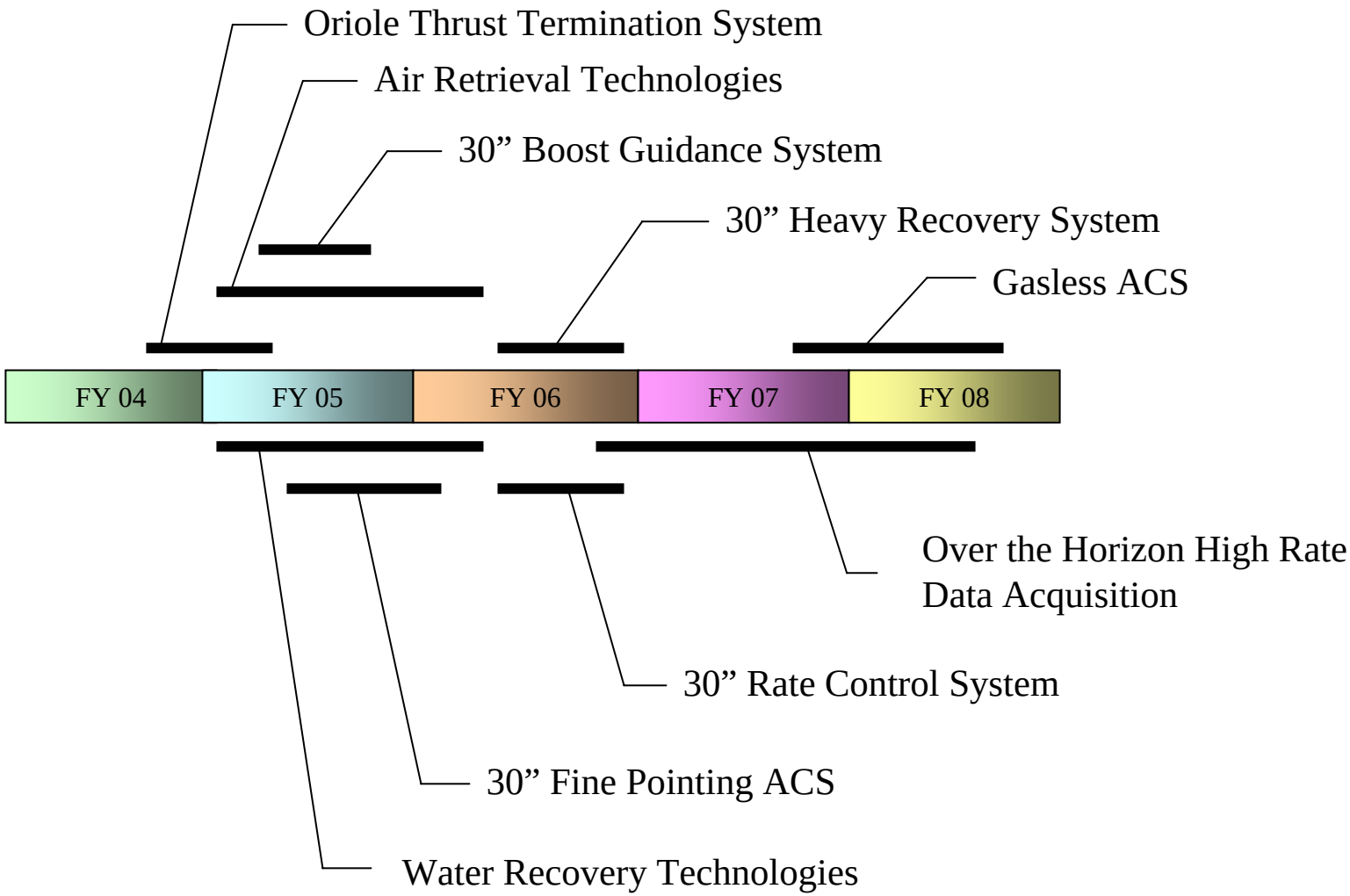
- Science / Technology Connection
  - Priority #1 = Continue with ACS Development
  - Priority #2 = Expansion of Vehicle Capabilities
    - Support Larger Apertures
      - Develop basic vehicles
      - Upgrade subsystems so new vehicle can be flown at all ranges
    - Mesospheric Sounder

  Priority #3 = Provide Longer Observation Times
- Funding sets the pace for the development efforts
- The SRPO not only welcomes input from the SRWG, it requires it…
- Current technology development phasing plan is presented in following charts

Vehicle Technology Timeline



System Technology Timeline



Technology Funding Phasing Plan

	FY 04	FY 05	FY 06	FY 07	FY 08
Talos-Oriole	$ 800 K				
Talos-Taurus-Oriole	$ 1200 K				
Oriole Thrust Termination System	$ 200 K	$ 300 K			
MRLS-Dart	$ 100K	$ 300 K			
30” Boost Guidance System		$ 400 K			
Air Retrieval Technologies		$ 200 K	$ 200 K		
Water Recovery Technologies		$ 200 K	$ 300 K		
30” Fine Pointing ACS		$ 100 K	$ 100 K		
Terrier-Patriot		$ 100 K	$ 400 K		
30” Rate Control System			$ 200 K		
30” Heavy Recovery System			$ 600 K		
HASR Recovery System Technologies			$ 500 K	$ 1,000 K	
Over the Horizon High Rate Data Acquisition			$ 500 K	$ 500 K	$ 500 K
Gasless ACS				$ 500 K	$ 1,000 K
Guided Trajectory Technologies				$ 400 K	$ 800 K
HASR Capability Expansion Study				$ 100 K	
Reusable Booster Study				$ 50 K	$ 100 K
Misc (minor technologies)				$ 200 K	$ 300 K
Technology Rockets (vehicle costs)	$ 200 K	$ 200 K	$200 K	$ 250 K	$ 300 K
TOTAL	**$ 2.3 M**	**$ 1.8 M**	**$ 3.0 M**	**$ 3.0 M**	**$ 3.0 M**

IV. Coarse Gyro Attitude Determination

- The suggestions of the SRWG are duly noted and will be implemented